NASA Continuous Risk Management (CRM) CQSDI 2-4 March 03

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Definition of Risk

"The combination of (1) the probability (qualitative or quantitative) that a program or project will experience an undesired event such as a cost overrun, schedule slippage, safety mishap, compromise of security, or failure to achieve a needed technological breakthrough; and (2) the consequences, impact, or severity of the undesired event were it to occur."

Structure of Risk

Risk always involves the **Likelihood** (A.K.A. Probability) that an undesired event will occur.

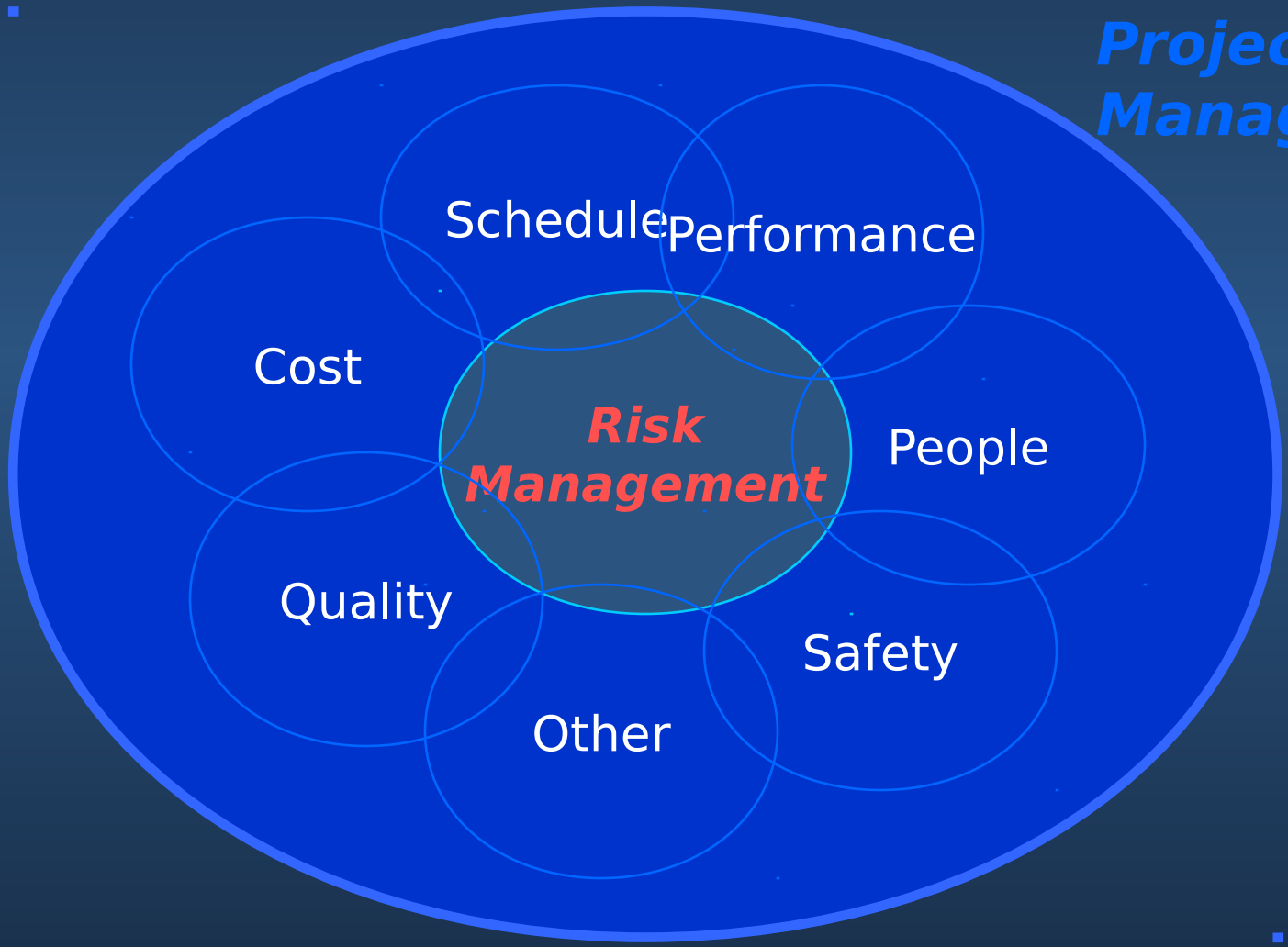
Risk should consider the **Impact** (A.K.A. consequence) of the event should it occur

Qualitative or Quantitative

Qualitative or Quantitative

Risk = Likelihood * Impact

Risk Management & Project Management



Why Do Continuous Risk Management?

CRM activities directly support good management by:

- **Early identification of potential problems**
- **Setting priorities**
- **More efficient use of resources**
- **Involving personnel at all levels of the project Promoting teamwork**
- **Providing critical information for tradeoffs and decision making**

Who does Risk Management ?

- The Project Manager is responsible for risk management
- The designated Project Risk Manager facilitates and implements CRM
- Each member of the project team is responsible for actively participating in the risk management process
- Everyone does risk management (all stakeholders)

What is Continuous Risk Management?

- A management practice with processes, methods, and tools for managing risks in a project.
- It provides a disciplined environment for proactive decision making to:
  - assess continually what could go wrong (risks)
  - determine which risks are important to deal with
  - implement strategies to deal with those risks
  - assure and measure effectiveness of the implemented strategies

Continuous Risk Management Process

1. Identify
2. Analyze
3. Plan
4. Track
5. Control
6. Communicate & Document

CRM Process

- **Identify:** Continuously sea for risks
  - Clearly state the condition an consequence
- **Analyze:** Evaluate each ris
  - Attributes of the risk
    - Impact
    - Probability
    - Timeframe
  - Group similar risks with a common basis together
  - Prioritize and rank the risk

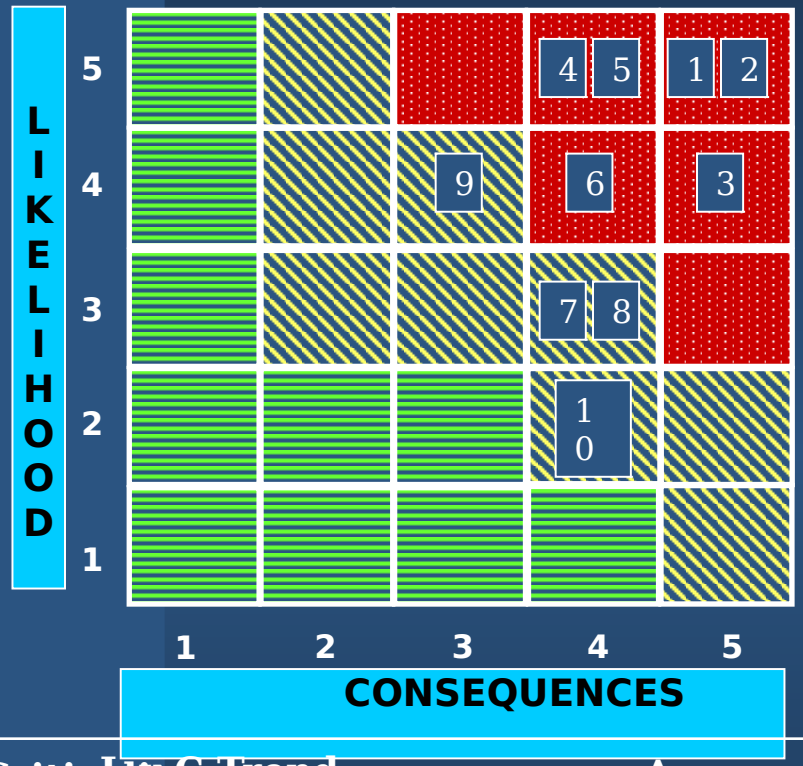
Tools: Team Meeting, Brainstorming, Safety and Reliability Analysis, LLIS Periodic Reporting, Schedule Status, Reviews, Test Results, WBS, etc.

Tools: Experience and Judgment, Comparison Ranking, Uncertainty Analysis of Projected Cost, Schedule and Performance, PRA Methodology, Statistical Analysis of Historical Data

EXAMPLE

Project XYZ Top Risks

EXAMPLE



Criticality	LLC Trend	Approach
High	Decreasing (Improving)	M - Mitigate
Med	Increasing (Worsening)	W - Watch
Low	Unchanged	A - Accept
	New Since Last Period	R - Research

Rank & Trend	Risk ID	Approach	Risk Title
1	SLI-P1-02	M	Thermal Vacuum/Acoustic Test
2	SLI-P2-06	W	On-Orbit Propellant Transfer
3	ISS-P1-03	M	Aggressive Schedule
4	ISS-P4-08	M	Government Furnished Property (GFP)
5	SRB-P1-05	M	Hot Fire Test Schedule Slip
6	UG-P1-01	M	Design Launch Weight Exceeds the Shuttle Capacity
7	SRB-P5-04	R	Returnability Requirement
8	HST-P9-09	W	12 Year Life Certification
9	SLI-P4-07	M	Reboost Engine/Thruster Lives
10	ISS-P1-15	M	Unachievable Thruster Technology

Risk Consequence Definitions

	1. Very Low	2. Low	3. Moderate	4. High	5. Very High
Technical Performance	Minimal or no impact to full mission or technical success/exit criteria or margins. Same approach retained	Minor impact to full mission or technical success/exit criteria, but can handle within established margins. Same approach retained.	Moderate impact to full mission or technical success/exit criteria, but can handle within established margins. Workarounds available.	Major impact to full mission or technical success criteria, but still meet minimum mission success/exit criteria, threatens established margins. Workarounds available.	Loss of life, vehicle, spacecraft, or can not meet minimum mission or technical success/exit criteria. No alternatives exist.
Schedule	Minimal or no schedule impact, but can handle within schedule reserve; no impact to critical path	Minor schedule impact, but can handle within schedule reserve; no impact to critical path	impact to critical path, but can handle within schedule reserve, no impact to milestones	Significant impact to critical path, and can not meet established lower level milestone	Major impact to critical path and can not meet major milestone
Cost	Minimal or no cost impact or increase over that allocated, and can be handled within available reserves	Minor cost impact, but can be handled within available reserves	Causes cost Impact and use of allocated reserves	Causes cost impact and may exceed allocated reserves and may require resources from another source	Causes major cost impact and requires additional budget resources from another source

Example

Risk Likelihood Definitions

Likelihood: What is the likelihood the situation or circumstance will happen?		
5 Very High	**Very likely to occur. Your team's process cannot prevent this event, no alternate approaches or processes are available. Requires immediate management attention.**	
4 High	**Highly likely to occur. Your team's process cannot prevent this event, but a different approach or process might require management's attention.**	
3 Moderate	**Likely to occur. Your team's process may prevent this event, but additional actions will be required**	
2 Low	**Not Likely to occur. Your team's process is usually sufficient to prevent this type of event**	
1 Very Low	**Very unlikely. Your team's process is sufficient to prevent this event**	

Example

CRM Process

- **Plan: Develop strategies to mitigate risks**
  - Assign risk, make sure it does not fall "through the cracks"
    - Keep, delegate, transfer
  - Determine action
    - Mitigate, Accept, watch, Research,
    - Based on knowledge and resources (cost, schedule, personnel, etc.)
  - Document action
    - Action items or a risk task plan

Tools: Risk List, Action Item List, Cost Benefit Analysis, Safety Analysis PRA

Definitions

The approaches for responding to risk are as follows (NPG 8000.4):

a. Mitigate. **Risk mitigation may be achieved by applying methods aimed at eliminating the risk or reducing the likelihood and/or consequence of a risk. This may be accomplished through engineering, schedule, or budgetary changes to designs, processes, or procedures; or alternate paths and approaches.**

b. Accept. **The PM shall establish the criteria for accepting risks, document the rationale for accepting individual risks and include the signed formal acceptance within the risk acceptance records. One criteria for accepting risk is to have a documented, tested, and signed contingency or recovery plan in place to respond to the consequences of an accepted risk should that risk manifest itself as an undesired event.**

c. Research. **This includes the collection of additional information, evaluation, and reporting of results on which to base future decisions or, sometimes, to reduce the uncertainty surrounding risk estimates.**

d. Watch/Monitor. **This includes deciding not to take immediate action, but to track, survey, or watch the trends and behavior of risk indicators over time.**

CRM Process

- **Track**: Monitor activities
  - Collect data
  - Monitor "watched" risks
  - Set triggers and thresholds
  - Recognize that risk threat and ranking will change as mitigation plans are implemented
  - Monitor risk reduction activities of the plan

Tools: Metrics, Trend Data, Cost and Schedule Variances, Status Reports, Performance Indicators

Tools: Metrics, Trigger Levels, PERT Charts, Cost Benefit Analysis

- **Control**: Correct for deviations from mitigation plan
  - Analyze reports
    - Is the mitigation plan working
  - Decide how to proceed
    - Stay on course
    - Adjust or revise the plan
    - Close the risk

CRM Process

- **Communicate and Document**: Provide feedback
  - Keep project team, management chain and stakeholders informed
    - Timely communication
    - Clear definition of risk
    - Avoid multiple messages
    - Full disclosure
      - Successful mitigation and why
      - Cost and benefits of mitigation
      - Failed mitigation and reasons
      - Risk relationships that were not obvious
    - Listen to team's specific concerns
  - Utilize effective configuration management process

Tools: CRM Data Base, E Mail, Status Meetings, Reports, Reviews

Risk Management Training

2-day Basic CRM Course. First day is intensive lecture, exercise and discussion. Second day is project focused workshop developing a risk list and Risk Management Plan elements for Risk analysis

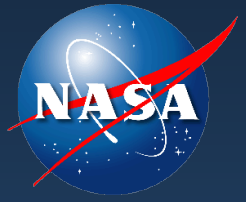
1-day Project Focused CRM Course. ½-day of lecture focused on specific weaknesses in the Program/Project Risk Management process followed by ½-day workshop to hone and improve skills in weak areas

30 min – ½-day CRM Overviews. Presentations to provide an understanding and overview of CRM to

Risk Management Training

1-day CRM for Mission Operations Course. Designed to meet the specific and unique needs of missions post-launch. The unique and difficult nature of maintaining and managing on orbit assets throughout their lifecycle and through disposal are addressed in this course

Advanced CRM Course. 5-day course for Project Managers, Systems Engineers and other senior level project members. Course covers case studies, lessons learned, tools, and techniques to manage risk over the project life cycle



Summary

- **RM supports the decision making process**
- **RM is part of good Project Management**
- **Disciplined and Rigorous Risk Management practices are essential to achieving Mission Success**
- **RM must be performed at all levels of the organization to be effective**

(http://crm.nasa.gov/ and http://smo.gsfc.nasa.gov/)